

**WHAT IS CLAIMED IS:**

- 1       1. An ADSL POTS splitter including an enhanced low pass filter, the enhanced low  
2       pass filter, comprising:  
3             a first filter capacitor including a first lead and a second lead;  
4             a first non-isolated inductor including a first winding and a second winding;  
5       and  
6             an isolated inductor connected to the first non-isolated inductor and including  
7       a first winding and a second winding, the first winding of the isolated inductor  
8       connected in series with the first winding of the first non-isolated inductor and to  
9       the first lead of the first filter capacitor, the second winding of the isolated  
10      inductor connected in series with the second winding of the first non-isolated  
11      inductor and to the second lead of the first filter capacitor, wherein the first non-  
12      isolated inductor has a respective DC saturation current and the isolated inductor  
13      has a respective DC saturation current, the DC saturation current of the first non-  
14      isolated inductor being substantially greater than the DC saturation current of the  
15      isolated inductor for achieving higher inductance in the isolated inductor.
- 1       2. The enhanced low pass filter of claim 1, further comprising:  
2             a common mode choke including a first winding and a second winding, the  
3       first winding of the common mode choke connected in series with the first  
4       winding of the first non-isolated inductor and with the first winding of the isolated  
5       inductor, the second winding of the common mode choke connected in series with  
6       the second winding of the first non-isolated inductor and with the second winding  
7       of the isolated inductor.
- 1       3. The enhanced low pass filter of claim 2 wherein the common mode choke is  
2       connected between the first non-isolated inductor and the first filter capacitor.

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- 1 4. The enhanced low pass filter of claim 2 wherein the common mode choke is a  
2 bifilar wound inductor.
- 1 5. The enhanced low pass filter of claim 4 wherein the first non-isolated inductor has  
2 a respective DC saturation current and the common mode choke has a respective  
3 DC saturation current, the DC saturation current of the first non-isolated inductor  
4 being substantially greater than the DC saturation current of the common mode  
5 choke.
- 1 6. The enhanced low pass filter of claim 1 wherein the isolated inductor is essentially  
2 the same physical size as than the first non-isolated inductor.
- 1 7. The enhanced low pass filter of claim 2, further comprising:  
2 an inductor damping resistor connected in parallel with each said winding of  
3 each said inductor; and  
4 a common mode choke damping resistor connected in parallel with each  
5 winding of the common mode choke.
- 1 8. The enhanced low pass filter of claim 7, further comprising:  
2 an attenuation pole tuning capacitor connected in parallel with each said  
3 winding of the isolated inductor.
- 1 9. The enhanced low pass filter of claim 1, further comprising:  
2 an inductor damping resistor connected in parallel with each said winding of  
3 each said inductor.
- 1 10. The enhanced low pass filter of claim 9, further comprising:  
2 an attenuation pole tuning capacitor connected in parallel with each said  
3 winding of the isolated inductor.
- 1 11. The enhanced low pass filter of claim 1, further comprising:

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2 a second non-isolated inductor connected to the first non-isolated inductor and  
3 including a first winding and a second winding, the first winding of the second  
4 non-isolated inductor connected in series with the first winding of the first non-  
5 isolated inductor, the second winding of the second non-isolated inductor  
6 connected in series with the second winding of the first non-isolated inductor.

1 12. The enhanced low pass filter of claim 11 wherein the first non-isolated inductor  
2 and the second non-isolated inductor each have respective physical attributes and  
3 respective electrical attributes, said physical and electrical attributes of the first  
4 non-isolated inductor being essentially the same as said physical and electrical  
5 attributes of the second non-isolated inductor.

1 13. The enhanced low pass filter of claim 12 wherein said respective physical and  
2 electrical attributes of the first and the second non-isolated inductors include  
3 physical size and DC saturation current level, respectively.

1 14. The enhanced low pass filter of claim 12 wherein the isolated inductor has  
2 respective physical attributes, said physical attributes of the first and the second  
3 non-isolated inductors being essentially the same as said physical attributes of the  
4 isolated inductor.

1 15. The enhanced low pass filter of claim 14 wherein said respective physical  
2 attributes of the first non-isolated inductor include physical size.

1 16. The enhanced low pass filter of claim 11, further comprising:  
2 an inductor damping resistor connected in parallel with each said winding of  
3 each said inductor.

1 17. The enhanced low pass filter of claim 16, further comprising:  
2 an attenuation pole tuning capacitor connected in parallel with each said  
3 winding of the isolated inductor.

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1 18. The enhanced low pass filter of claim 11 wherein:

2 each the first and the second non-isolated inductors includes a respective dual  
3 section bobbin; and

4 each winding of the first and the second non-isolated inductors is wound on a  
5 respective section of the respective dual section bobbin.

- 1 19. An ADSL POTS splitter including an enhanced low pass filter, the enhanced low  
2 pass filter, comprising:  
3 a first filter capacitor including a first lead and a second lead;  
4 a first non-isolated inductor including a first winding and a second winding;  
5 a second non-isolated inductor connected to the first non-isolated inductor and  
6 including a first winding and a second winding, the first winding of the second  
7 non-isolated inductor connected in series with the first winding of the first non-  
8 isolated inductor, the second winding of the second non-isolated inductor  
9 connected in series with the second winding of the first non-isolated inductor;  
10 a isolated inductor connected to the first non-isolated inductor and including a  
11 first winding and a second winding, the first winding of the isolated inductor  
12 connected in series with the first winding of the first non-isolated inductor and to  
13 the first lead of the first filter capacitor, the second winding of the isolated  
14 inductor connected in series with the second winding of the first non-isolated  
15 inductor and to the second lead of the first filter capacitor, wherein the first non-  
16 isolated inductor has a respective DC saturation current and the isolated inductor  
17 has a respective DC saturation current, the DC saturation current of the first non-  
18 isolated inductor being substantially greater than the DC saturation current of the  
19 isolated inductor for achieving higher inductance in the isolated inductor, the  
20 isolated inductor being essentially the same physical size as than the first non-  
21 isolated inductor; and  
22 a common mode choke connected between the first non-isolated inductor and  
23 the first filter capacitor, the common mode choke including a first winding and a  
24 second winding, the first winding of the common mode choke connected in series  
25 with the first winding of the first non-isolated inductor and with the first winding  
26 of the isolated inductor, the second winding of the common mode choke  
27 connected in series with the second winding of the first non-isolated inductor and  
28 with the second winding of the isolated inductor.

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1 20. The enhanced low pass filter of claim 19 wherein the first non-isolated inductor  
2 and the second non-isolated inductor each have respective physical attributes and  
3 respective electrical attributes, said physical and electrical attributes of the first  
4 non-isolated inductor being essentially the same as said physical and electrical  
5 attributes of the second non-isolated inductor.

1 21. The enhanced low pass filter of claim 20 wherein said respective physical and  
2 electrical attributes of the first and the second non-isolated inductors include  
3 physical size and DC saturation current level, respectively.

1 22. The enhanced low pass filter of claim 20 wherein the isolated inductor has  
2 respective physical attributes and respective electrical attributes, said physical  
3 attributes of the first and the second non-isolated inductors being essentially the  
4 same as said physical attributes of the isolated inductor, said electrical attributes  
5 of the first and the second non-isolated inductors being substantially different than  
6 said electrical attributes of the isolated inductor.

1 23. The enhanced low pass filter of claim 22 wherein said respective physical and  
2 electrical attributes of the first non-isolated inductor, the second non-isolated  
3 inductor and the isolated inductor include physical size and DC saturation current  
4 level, respectively.

1 24. The enhanced low pass filter of claim 19, further comprising:  
2 a second isolated inductor connected to the isolated inductor and including a  
3 first winding and a second winding, the first winding of the second isolated  
4 inductor connected in series with the first winding of the isolated inductor, the  
5 second winding of the second isolated inductor connected in series with the  
6 second winding of the isolated inductor.

1 25. An ADSL POTS splitter including an enhanced low pass filter, the enhanced low  
2 pass filter, comprising:  
3 a first filter capacitor including a first lead and a second lead;  
4 a first non-isolated inductor including a first winding and a second winding;  
5 a second non-isolated inductor connected to the first non-isolated inductor and  
6 including a first winding and a second winding, the first winding of the second  
7 non-isolated inductor connected in series with the first winding of the first non-  
8 isolated inductor, the second winding of the second non-isolated inductor  
9 connected in series with the second winding of the first non-isolated inductor;  
10 a first isolated inductor connected to the first non-isolated inductor and  
11 including a first winding and a second winding, the first winding of the first  
12 isolated inductor connected in series with the first winding of the first non-isolated  
13 inductor and to the first lead of the first filter capacitor, the second winding of the  
14 first isolated inductor connected in series with the second winding of the first non-  
15 isolated inductor and to the second lead of the first filter capacitor, wherein the  
16 first non-isolated inductor has a respective DC saturation current and the first  
17 isolated inductor has a respective DC saturation current, the DC saturation current  
18 of the first non-isolated inductor being substantially greater than the DC saturation  
19 current of first isolated inductor for achieving higher inductance in the first  
20 isolated inductor, the first isolated inductor being essentially the same physical  
21 size as than the first non-isolated inductor;  
22 a second isolated inductor connected to the first isolated inductor and  
23 including a first winding and a second winding, the first winding of the second  
24 isolated inductor connected in series with the first winding of the first isolated  
25 inductor, the second winding of the second isolated inductor connected in series  
26 with the second winding of the first isolated inductor; and  
27 a common mode choke connected between the first non-isolated inductor and  
28 the first filter capacitor, the common mode choke including a first winding and a  
29 second winding, the first winding of the common mode choke connected in series  
30 with the first winding of the first non-isolated inductor and with the first winding

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of the first isolated inductor, the second winding of the common mode choke connected in series with the second winding of the first non-isolated inductor and with the second winding of the first isolated inductor.

26. The enhanced low pass filter of claim 25 wherein said inductors each have respective physical attributes and respective electrical attributes, said physical and electrical attributes of each said inductor being essentially the same.

27. The enhanced low pass filter of claim 26 wherein said respective physical and electrical attributes of each said inductor include physical size and DC saturation current level, respectively.

28. The enhanced low pass filter of claim 25, further comprising:  
an inductor damping resistor connected in parallel with each said winding of each said inductor.

29. The enhanced low pass filter of claim 28, further comprising:  
a first attenuation pole tuning capacitor connected in parallel across the first windings of the first and the second isolated inductors; and  
a second attenuation pole tuning capacitor connected in parallel across the second windings of the first and the second isolated inductors.

30. The enhanced low pass filter of claim 25 wherein:  
each said inductor includes a respective dual section bobbin; and  
each winding of each said inductor is wound on a respective section of the respective dual section bobbin.



- 1 31. A communication apparatus, comprising:  
2 a digital subscriber line access multiplexor;  
3 a central office ADSL transceiver unit electrically connected to the DSLAM;  
4 and  
5 a POTS splitter including an enhanced low pass filter, the enhanced low pass  
6 filter electrically connected to the central office ADSL transceiver unit and to a  
7 remote communication apparatus, the enhanced low pass filter comprising:  
8 a first filter capacitor including a first lead and a second lead;  
9 a first non-isolated inductor including a first winding and a  
10 second winding; and  
11 an isolated inductor including a first winding and a second  
12 winding, the first winding of the isolated inductor connected in  
13 series with the first winding of the first non-isolated inductor and to  
14 the first lead of the first filter capacitor, the second winding of the  
15 isolated inductor connected in series with the second winding of  
16 the first non-isolated inductor and to the second lead of the first  
17 filter capacitor, wherein the first non-isolated inductor has a  
18 respective DC saturation current and the isolated inductor has a  
19 respective DC saturation current, the DC saturation current of the  
20 first non-isolated inductor being substantially greater than the DC  
21 saturation current of the isolated inductor for achieving higher  
22 inductance in the isolated inductor.

1 32. A communication apparatus, comprising:

2 a digital subscriber line access multiplexor;

3 a central office ADSL transceiver unit electrically connected to the DSLAM;

4 and

5 a POTS splitter including an enhanced low pass filter, the enhanced low pass  
6 filter electrically connected to the central office ADSL transceiver unit and to a  
7 remote communication apparatus, the enhanced low pass filter comprising:

8 a first filter capacitor including a first lead and a second lead;

9 a first non-isolated inductor including a first winding and a  
10 second winding;

11 a second non-isolated inductor connected to the first non-  
12 isolated inductor and including a first winding and a second  
13 winding, the first winding of the second non-isolated inductor  
14 connected in series with the first winding of the first non-isolated  
15 inductor, the second winding of the second non-isolated inductor  
16 connected in series with the second winding of the first non-  
17 isolated inductor;

18 an isolated inductor connected to the first non-isolated inductor  
19 and including a first winding and a second winding, the first  
20 winding of the isolated inductor connected in series with the first  
21 winding of the first non-isolated inductor and to the first lead of the  
22 first filter capacitor, the second winding of the isolated inductor  
23 connected in series with the second winding of the first non-  
24 isolated inductor and to the second lead of the first filter capacitor,  
25 wherein the first non-isolated inductor has a respective DC  
26 saturation current and the isolated inductor has a respective DC  
27 saturation current, the DC saturation current of the first non-  
28 isolated inductor being substantially greater than the DC saturation  
29 current of the isolated inductor for achieving higher inductance in  
30 the isolated inductor, the isolated inductor being essentially the  
31 same physical size as than the first non-isolated inductor; and

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32 a common mode choke connected between the first non-  
33 isolated inductor and the first filter capacitor, the common mode  
34 choke including a first winding and a second winding, the first  
35 winding of the common mode choke connected in series with the  
36 first winding of the first non-isolated inductor and with the first  
37 winding of the isolated inductor, the second winding of the  
38 common mode choke connected in series with the second winding  
39 of the first non-isolated inductor and with the second winding of  
40 the isolated inductor.

1 33. The enhanced low pass filter of claim 32 wherein the common mode choke is a  
2 bifilar wound inductor.

1 34. The enhanced low pass filter of claim 33 wherein the first non-isolated inductor  
2 has a respective DC saturation current and the common mode choke has a  
3 respective DC saturation current, the DC saturation current of the first non-  
4 isolated inductor being substantially greater than the DC saturation current of the  
5 common mode choke.

1 35. The enhanced low pass filter of claim 34, further comprising:  
2 an inductor damping resistor connected in parallel with each said winding of  
3 each said inductor; and  
4 a common mode choke damping resistor connected in parallel with each  
5 winding of the common mode choke.

1 36. The enhanced low pass filter of claim 35, further comprising:  
2 an attenuation pole tuning capacitor connected in parallel with each said  
3 winding of the isolated inductor.

1 37. The enhanced low pass filter of claim 32, further comprising:

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2 a second non-isolated inductor connected to the first non-isolated inductor and  
3 including a first winding and a second winding, the first winding of the second  
4 non-isolated inductor connected in series with the first winding of the first non-  
5 isolated inductor, the second winding of the second non-isolated inductor  
6 connected in series with the second winding of the first non-isolated inductor.

1 38. The enhanced low pass filter of claim 37 wherein the first non-isolated inductor  
2 and the second non-isolated inductor each have respective physical attributes and  
3 respective electrical attributes, said physical and electrical attributes of the first  
4 non-isolated inductor being essentially the same as said physical and electrical  
5 attributes of the second non-isolated inductor.

1 39. The enhanced low pass filter of claim 38 wherein said respective physical and  
2 electrical attributes of the first and the second non-isolated inductors include  
3 physical size and DC saturation current level, respectively.

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- 1 40. An ADSL system, comprising:
  - 2 a remote communication apparatus; and
  - 3 a central office communication apparatus including an enhanced low pass
  - 4 filter connected to the remote communication apparatus, the enhanced low pass
  - 5 filter comprising:
    - 6 a first filter capacitor including a first lead and a second lead;
    - 7 a first non-isolated inductor including a first winding and a
    - 8 second winding; and
    - 9 an isolated inductor including a first winding and a second
    - 10 winding, the first winding of the isolated inductor connected in
    - 11 series with the first winding of the first non-isolated inductor and to
    - 12 the first lead of the first filter capacitor, the second winding of the
    - 13 isolated inductor connected in series with the second winding of
    - 14 the first non-isolated inductor and to the second lead of the first
    - 15 filter capacitor, wherein the first non-isolated inductor has a
    - 16 respective DC saturation current and the isolated inductor has a
    - 17 respective DC saturation current, the DC saturation current of the
    - 18 first non-isolated inductor being substantially greater than the DC
    - 19 saturation current of the isolated inductor for achieving higher
    - 20 inductance in the isolated inductor.

1 41. An ADSL system, comprising:

2 a remote communication apparatus; and

3 a central office communication apparatus including an enhanced low pass  
4 filter connected to the remote communication apparatus, the enhanced low pass  
5 filter comprising:

6 a first filter capacitor including a first lead and a second lead;

7 a first non-isolated inductor including a first winding and a  
8 second winding;

9 a second non-isolated inductor connected to the first non-  
10 isolated inductor and including a first winding and a second  
11 winding, the first winding of the second non-isolated inductor  
12 connected in series with the first winding of the first non-isolated  
13 inductor, the second winding of the second non-isolated inductor  
14 connected in series with the second winding of the first non-  
15 isolated inductor.

16 an isolated inductor connected to the first non-isolated inductor  
17 and including a first winding and a second winding, the first  
18 winding of the isolated inductor connected in series with the first  
19 winding of the first non-isolated inductor and to the first lead of the  
20 first filter capacitor, the second winding of the isolated inductor  
21 connected in series with the second winding of the first non-  
22 isolated inductor and to the second lead of the first filter capacitor,  
23 wherein the first non-isolated inductor has a respective DC  
24 saturation current and the isolated inductor has a respective DC  
25 saturation current, the DC saturation current of the first non-  
26 isolated inductor being substantially greater than the DC saturation  
27 current of the isolated inductor for achieving higher inductance in  
28 the isolated inductor, the isolated inductor being essentially the  
29 same physical size as than the first non-isolated inductor; and

30 a common mode choke connected between the first non-  
31 isolated inductor and the first filter capacitor, the common mode

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32 choke including a first winding and a second winding, the first  
33 winding of the common mode choke connected in series with the  
34 first winding of the first non-isolated inductor and with the first  
35 winding of the isolated inductor, the second winding of the  
36 common mode choke connected in series with the second winding  
37 of the first non-isolated inductor and with the second winding of  
38 the isolated inductor.

1 42. The enhanced low pass filter of claim 41 wherein the common mode choke is a  
2 bifilar wound inductor.

1 43. The enhanced low pass filter of claim 42 wherein the first non-isolated inductor  
2 has a respective DC saturation current and the common mode choke has a  
3 respective DC saturation current, the DC saturation current of the first non-  
4 isolated inductor being substantially greater than the DC saturation current of the  
5 common mode choke.

1 44. The enhanced low pass filter of claim 41, further comprising:  
2 an inductor damping resistor connected in parallel with each said winding of  
3 each said inductor; and  
4 a common mode choke damping resistor connected in parallel with each  
5 winding of the common mode choke.

1 45. The enhanced low pass filter of claim 44, further comprising:  
2 an attenuation pole tuning capacitor connected in parallel with each said  
3 winding of the isolated inductor.

1 46. The enhanced low pass filter of claim 41 wherein the first non-isolated inductor  
2 and the second non-isolated inductor each have respective physical attributes and  
3 respective electrical attributes, said physical and electrical attributes of the first

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4 non-isolated inductor being essentially the same as said physical and electrical  
5 attributes of the second non-isolated inductor.

1 47. The enhanced low pass filter of claim 46 wherein said respective physical and  
2 electrical attributes of the first and the second non-isolated inductors include  
3 physical size and DC saturation current level, respectively.